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## Trauma Case Reports

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## Case Report

## Vertical axis dislocation with coronal fracture of the patella: A previously unreported injury pattern

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## ABSTRACT

The patella usually dislocates laterally. Less commonly, intra-articular dislocation occurs about either the vertical or horizontal axis. Patellar fractures are generally transverse with varying degrees of comminution, and less frequently vertical in the sagittal plane. We present a 9-year follow-up of a previously undescribed coronal patellar fracture associated with vertical axis dislocation of the patella. The mechanism of this severe injury is described.

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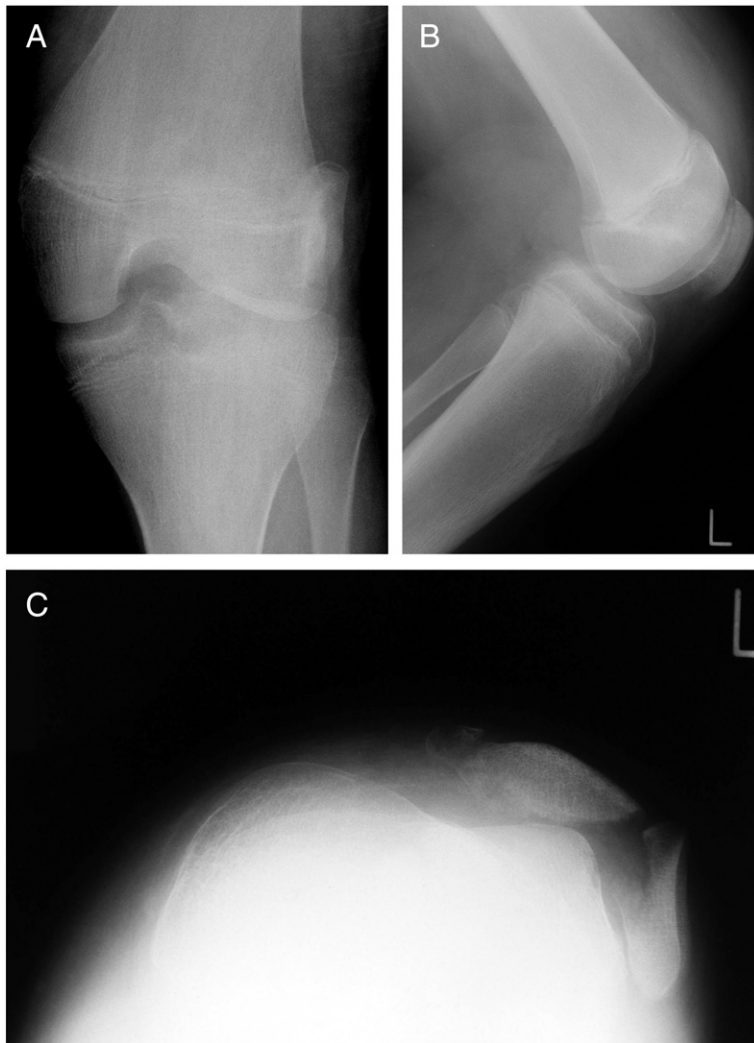
## Case report

A 14-year-old boy fell down stairs injuring his left knee. Anteroposterior and lateral plain radiographs obtained in the emergency room were interpreted as having shown no bony injury and he was discharged with a knee bandage. He re-attended 11 days later with ongoing severe pain and limitation of knee motion. Review of the initial radiographs revealed the patella to be laterally situated on the anteroposterior view with an abnormally thin profile on the lateral projection (Fig. 1A,B). Skyline view, obtained at the second but not at the first attendance, showed lateral displacement of part of the patella into the lateral recess (Fig. 1C). Physes around the knee were still open. Computerised tomography (CT) of the left knee demonstrated a fracture through the mid-coronal plane of the patella, with lateral rotation and dislocation of the articular fragment into the lateral recess (Fig. 2).

Under general anaesthesia, arthroscopy was first carried out using standard portals. After the evacuation of 30 ml of serosanguineous effusion, the joint was irrigated. Inspection of the intercondylar notch, medial and lateral compartments revealed no additional injuries. Arthrotomy was then performed through a medial parapatellar approach. It confirmed the presence of a coronal fracture of the patella. The articular half was

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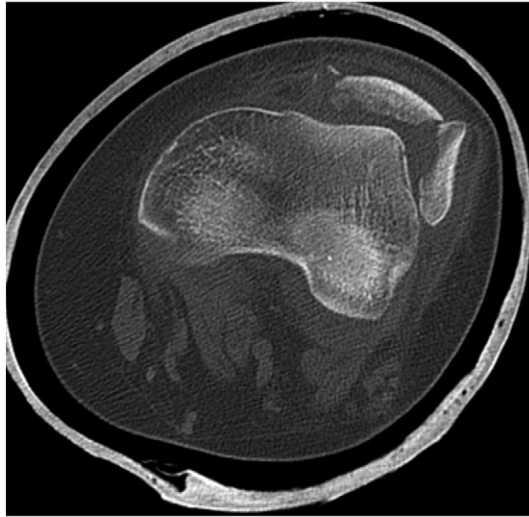


**Fig. 1.** (A) Anteroposterior radiograph of the left knee showing a laterally displaced patella. (B) An abnormally thin profile of the patella on lateral radiograph. (C) Dislocation of part of the patella on skyline view.

delivered out of the lateral recess, where it had dislocated into. Its lateral soft tissue attachments had remained intact. Its articular surface was well preserved except for a small loose piece, which was removed. The fracture was anatomically reduced and stabilised with medially placed trans-osseous absorbable vicryl sutures.

Post-operatively, he was immobilised in a cylinder cast for 6 weeks, at which time intensive physical therapy was commenced. Six months later, his knee remained markedly stiff with a 20-degree extension block and limitation of flexion at 60°. He underwent arthroscopic arthrolysis and manipulation under general anaesthesia. Full passive extension was obtained. However, the knee could only be flexed safely to 95°.

No further follow-up was available until recently at nine years post injury. He now works as a security officer and reports minimal pain in his left knee. He walks without a limp. There is mild atrophy of the left quadriceps muscles with no associated joint effusion or tenderness. His knee moves from 0° to 115° with no extension lag. Movements of the patella in the medio-lateral plane are full and painless. Up-to-date radiographs confirm sound fracture healing with no evidence of avascular necrosis. Mild to moderate



**Fig. 2.** Computerised axial tomogram of the left knee demonstrating a coronal fracture across the patella. The articular fragment has rotated posteriorly into the lateral recess such that its articular surface faces laterally.



**Fig. 3.** Plain radiographs of the left knee at 9-year follow-up. Patella has healed in good position with mild to moderate degeneration at the patella-femoral joint.

patello-femoral degeneration is present with narrowing of the joint space, upper pole osteophytosis, subchondral sclerosis and cyst formation. The patella is otherwise well located (Fig. 3).

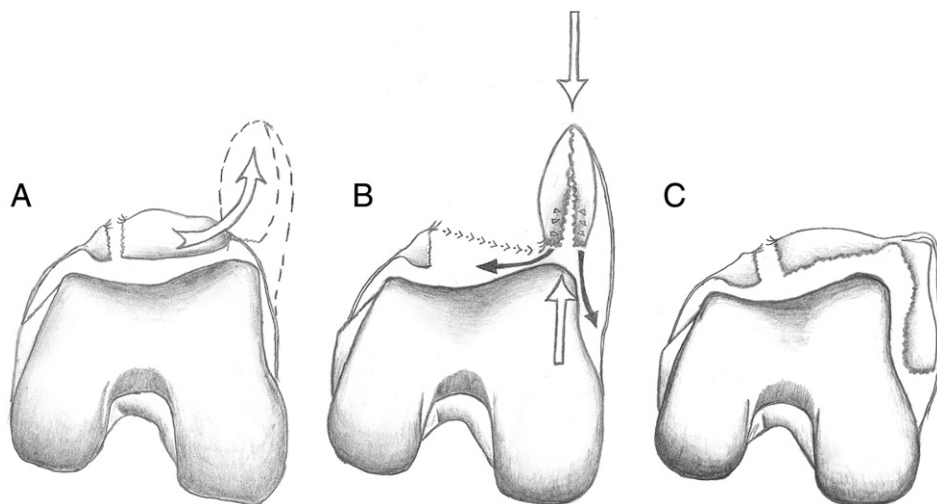
## Discussion

The AO/OTA classification categorises patellar fractures into 3 types. Type A fractures are extra-articular avulsions of either upper or lower pole of the patella while type B describes partial articular vertical fractures. Depending on the degree of comminution, the complete articular type C injuries range from the simple transverse to the stellate pattern [1]. In children, the sleeve fracture has been well documented at both upper and lower poles [2].

The patella usually dislocates laterally. Fractures associated with lateral patellar dislocation are avulsion of its medial border, and osteochondral fractures of the patella and lateral femoral condyle [3]. Intra-articular dislocation occurs less frequently with rotation of the patella about either its vertical or horizontal axis [4–8]. In cases of vertical axis rotation, which is five times less common than the horizontal variety, the patella has been found locked within the intercondylar groove [5], the lateral recess [6], a Hoffa fracture [7] and a Salter-Harris type III fracture of the lateral femoral condyle [8]. Most reported cases of intra-articular dislocation were irreducible by closed means and required open reduction.

The present study purports to describe a previously undescribed pattern of fracture-dislocation of the patella. Fig. 4 illustrates the proposed mechanism of injury. The patella initially started to dislocate laterally, leaving behind the small classic medial pole avulsion fracture as visualised on both skyline view and axial CT images. Instead of continuing to dislocate laterally when it reached the edge of the lateral femoral condyle, it rotated about its vertical axis coming to lie vertically upwards akin to the “dorsal fin” position of vertical patellar dislocation as described by Gamble et al. [5]. As the patella then descended vertically downwards, its exposed fracture surface impacted into the ridge of the lateral femoral condyle, causing to split vertically along its middle. The fragment bearing the whole of the articular surface dislocated into the lateral recess with the hyaline cartilage facing lateralward, while the dorsal fragment relocated medialward over the femoral trochlea.

This previously unreported injury pattern represents a variant of intra-articular patellar dislocation about the vertical axis with associated coronal fracture of the patella and vertical axis rotation of the fractured articular half. It represents a severe injury, which was not immediately recognised. At 9 years post injury, he has had a satisfactory outcome, considering the delay in diagnosis and treatment.



**Fig. 4.** Diagrammatic representation of mechanism of injury. (A) The patella begins dislocating lateralward leaving behind a small medial pole avulsion fracture. (B) At the level of the lateral femoral condyle, it dislocates vertically upwards instead of continuing laterally. (C) As it then descends back, it impacts into the lateral femoral condyle causing it to split into two halves. The articular half dislocates into the lateral recess while the dorsal half relocates medially over the femoral trochlea.

## Conflict of interest statement

All authors declare they have no conflict of interest.

## Funding

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